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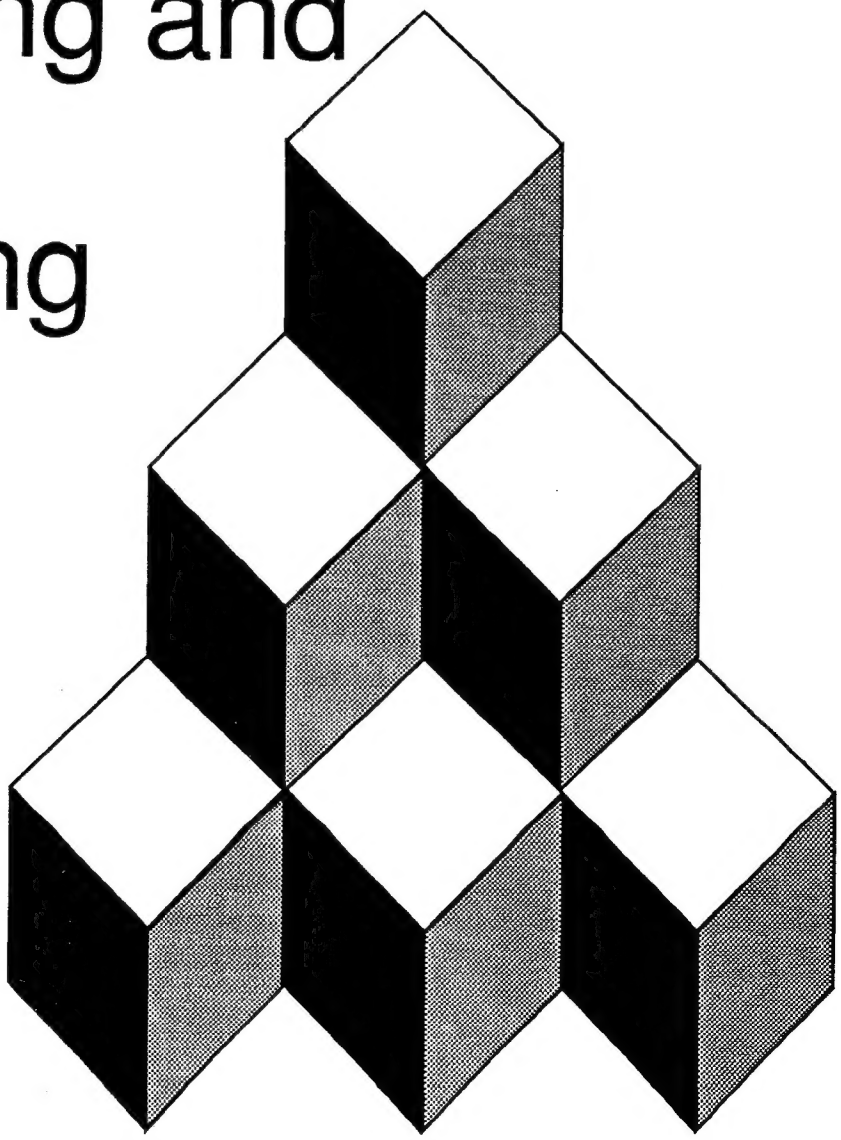
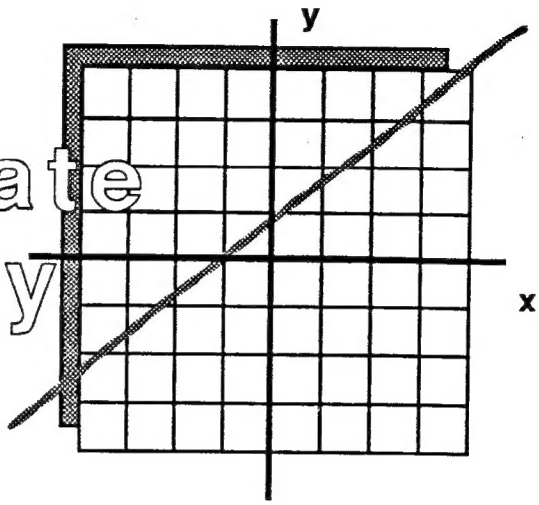
Tools for Active Teaching and Active Learning



Coordinate Geometry



An Interactive Introduction to Coordinate Geometry

For Macintosh and Apple // Series Computers

Ventura Educational Systems

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Introduction

Coordinate Geometry is an interactive learning system that has been designed to provide 7th grade enrichment through adult level instruction in mathematics. Several approaches to geometry instruction are combined in the design of this educational software package. Each instructional unit consists of a lesson, probe and quiz. The lesson presents the concepts pertaining to geometry and the Cartesian Plane. The probe mode allows the student to explore the concepts presented in the lesson and the quiz tests the student's understanding of the concepts.

The main instructional objectives of Coordinate Geometry are given in these educational objectives:

1. To provide computer based instruction in coordinate geometry by graphically representing material presented in the text.

2. To provide an easy-to-use format for exploring coordinate geometry concepts.

3. To measure the student's understanding of the topics presented in each unit using a percentage correct rating.

The main topics covered by this learning system are listed below:

(x,y)	Locating points on the Cartesian Plane.
Locus	Defining a locus using set notation.
Plane	Defining points, lines and planes.
y=x	The equation of a 45 degree line.
y=x+b	The concept of the y-intercept.
y=mx	The concepts of the slope of a line.
y=mx+b	The standard formula for the equation of a line.

Coordinate Geometry can be used in combination with other instructional approaches and closely parallels the geometry curriculum taught in most secondary schools. The program provides students with the opportunity to review and explore the concepts learned in mathematics classes. The lessons in each unit present the material in a step-by-step, self-paced manner. Each unit contains a probe module which can be used to explore the content of the lesson. A quiz for each unit assesses the student's mastery of the material and helps to provide reinforcement.

Supplementary materials are provided in this manual and are designed to be used in conjunction with the computer activities. The supplementary worksheets may be duplicated for classroom use and lab packs of the program disk are available from the publisher.

Credits

Software Design — **Ventura Educational Systems**

Instructional Technology and Programming — **Fred Ventura, Ph.D.**

Editor — **Marne Ventura, M.A.**

Dr. Fred Ventura is an experienced classroom teacher and has taught elementary, secondary and college levels. He holds a doctorate in education from the University of California, and presents workshops for educators on the instructional uses of microcomputers.

Marne Ventura is also an experienced classroom teacher and holds a masters degree in reading and language development from the University of California. As a seminar leader, Marne Ventura has assisted many teachers in learning about the educational opportunities that can be derived from the use of microcomputers in the classroom.

Other Publications Include:

Algebra Concepts
GeoArt: Geometry and Art Discovery Unit
Marine Life: Anatomy of a Fish
Anatomy of a Sea Lamprey
Chemaid: Introduction to the Periodic Table
The Worm: Invertebrate Anatomy
Protozoa: Introduction to Microorganisms
States: Geography Study Unit and Database
All About the Solar System
All About Simple Machines
SuperGraph
Geometry Concepts
Marine Invertebrates
Anatomy of a Shark
VisiFrog: Vertebrate Anatomy
Computer Concepts
Plant and Animal Cells
The Insect World
All About Matter
All About Light & Sound
Dr. Know: Experiments in Artificial Intelligence
Senses: Physiology of the Human Sense Organs
The Plant: Nature's Food Factory

Additional Program Disks

Many schools have more than one computer and to effectively use educational software require additional legal copies of a program. Additional program disks are available for use in a computer lab. The price is $10.00 per disk. Schools with a registered copy of any Ventura Educational Systems product may order additional copies of a program disk at any time. There is a 30 day warranty on original program disks. If for any reason a program disk becomes defective within 30 days of the date of purchase, Ventura Educational Systems will replace it at no charge.

An Overview of the Coordinate Geometry Learning System

Coordinate Geometry combines a variety of instructional techniques in an easy-to-use learning system. Each topic is introduced in the lesson where computer graphics are used to illustrate the concepts. Throughout the lesson standard set notation is used to describe the locus of points which is being discussed.

The program is designed so that the student selects a topic and then proceeds to the lesson, probe or quiz options. Students who uses Coordinate Geometry are able to determine the pace and direction of their learning.

Text and graphics are interactively presented during the use of this program. Students watch the display as the computer constructs geometric representations on the coordinate plane. Using the probe mode the student can manipulate variables to explore points, lines and planes. The proper set notation used to describe the student's selections is displayed on the screen as the computer creates the diagram on a grid.

In the quiz mode the computer's random number generating ability is employed to generate a unique set of problems each time the program is used. This makes it possible for students to use the program side-by-side and not be taking the same quiz and also to use the quiz more than once.

Activity pages are provided in this manual and are designed to be used in conjunction with and as follow-up to work at the computer. Teachers are encouraged to duplicate the supplementary materials and use them in conjunction with the program.

Materials

The Coordinate Geometry learning system includes these components:

Coordinate Geometry Program Disk	Documentation and Teacher's Guide with Reproducible Black Line Masters

Coordinate Geometry

Hardware Requirements

Coordinate Geometry is designed to work with most standardly configured computer systems. The hardware requirements are listed below:

- Apple //e, Apple //c or Apple//GS computer system, 64K RAM (minimum), Single or Dual Disk, Video Monitor (Color recommended), Storage Disk (DOS 3.3 format). Developed Using DOS 3.3/Applesoft BASIC and Assembler.

- Macintosh Plus, SE or II series computer system, 1Mb RAM(minimum), Single 800K Disk Drive or Hard Disk.

A Conceptual Framework for Coordinate Geometry

Coordinate geometry is an important topic of study because it is part of the foundation of mathematical knowledge that is necessary for success in the study of advanced mathematics and this knowledge is put to use in a variety of diverse fields.

The study of mathematics is most exciting when one is able to experiment and explore the concepts being learned. The computer is used to graphically represent the solution to a user-defined locus of points. The technique encourages the student to test ideas about points, lines and planes.

The philosophical approach taken in the design of Coordinate Geometry is to provide a computer based learning environment for studying the coordinate system. In each unit a self-paced lesson uses the computer to illustrate on a coordinate plane the concepts as they are being presented in the text. After completing a lesson, the student is encouraged to experiment with the ideas presented in the lesson by using the probe mode which allows the student to define a locus of points and the computer will automatically graph what the student has defined. Each unit concludes with a quiz where randomly generated problems present unique challenges to measure the student's progress.

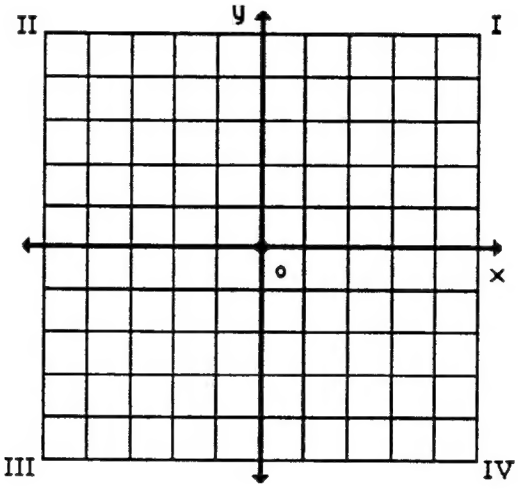
The Cartesian Coordinate System is derived from two straight lines, called axes, which intersect at a right angle. The point of intersection is called point O, the origin. The origin is used to establish the relative position of points on a plane. Any point on the plane can be defined using a pair of coordinates. The first coordinate, called the abscissa, is the position of the point relative to the x-axis. The second coordinate is called the ordinate and references the position of the point in terms of the y-axis.

The origin is the absolute center of the grid and divides the coordinate plane into four parts. Each section is called a quadrant and the quadrants are numbered using Roman numerals.

Lines can be defined on the coordinate plane using equations. The standard form for the equation of a line is y=mx+b, where m is the slope of the line and b is the y-intercept. The slope of a line is sometimes described as the rise over the run. The y-intercept is the value of the ordinate at the point where the line crosses the y-axis.

The Coordinate Plane

The figure below shows the standard Cartesian Plane used in coordinate geometry.



Getting Started

Before you begin using Coordinate Geometry, be sure you have ordered your backup of the program disk. Use the copy and store the original in a safe place. The purchaser of this program is entitled to keep one backup of this program for archival purposes. (Using the backup in a second computer or making more than one copy is considered a copyright infringement. Additional copies of the program disk are available and may be purchased by schools with computer labs.)

Apple // Users Only...

To start the Apple // version of Coordinate Geometry place the program disk in Drive 1. With the disk in place either power ON the system or restart by pressing CTRL-Open Apple-Reset or use PR#6 to warm-start

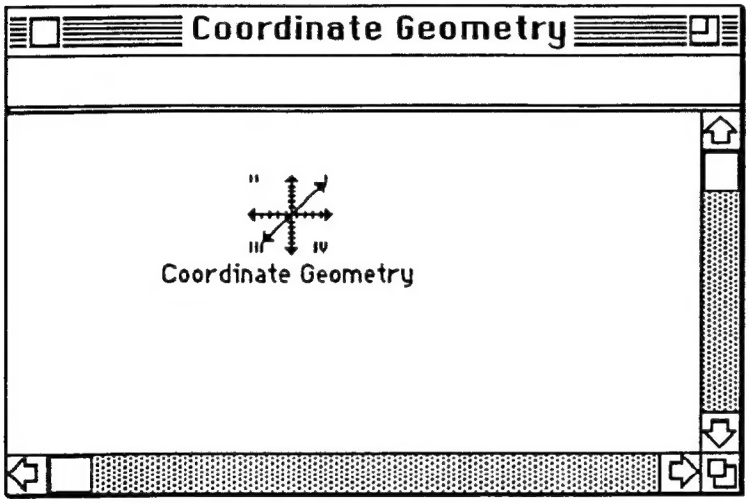
the systems. Please consult your Apple User's Guide for more complete system operating instructions.

Note: During execution of this program files are accessed from the program disk. Please keep the program disk in the drive while using this program.

After the computer has been started a title screen is presented. Press any key to complete the start-up procedure. In a few moments the Coordinate Geometry Main Menu screen is displayed.

Macintosh Users Only...

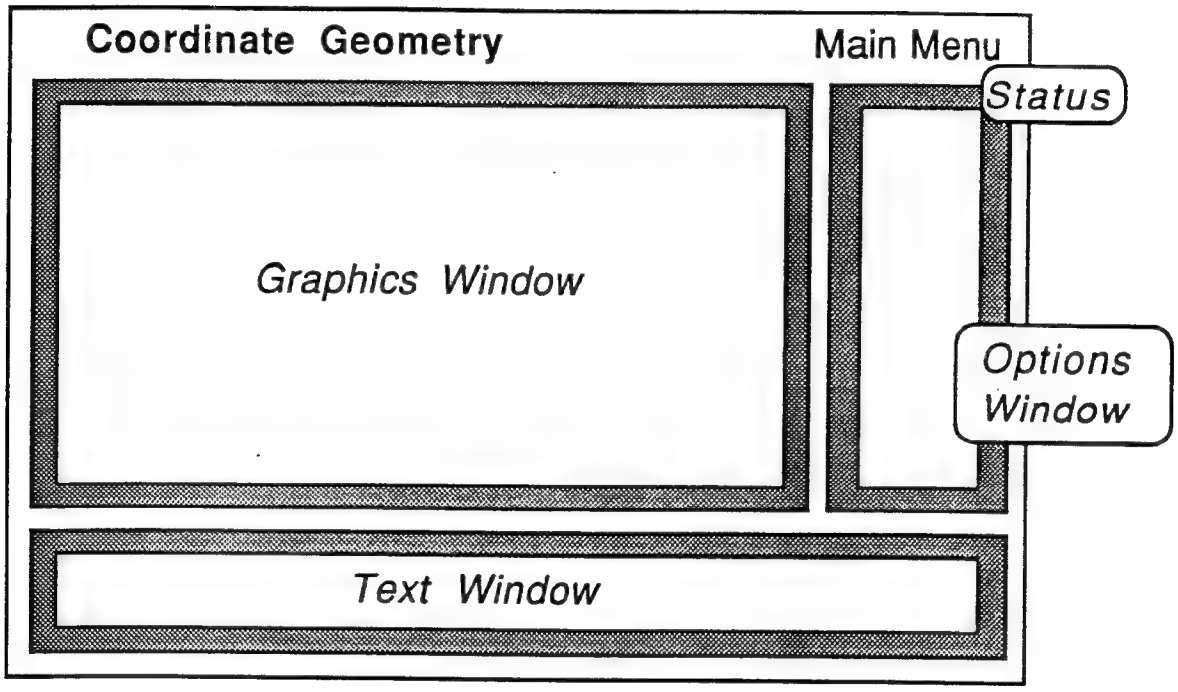
To start the Macintosh version of Coordinate Geometry, start the computer system in the normal manner then insert the Coordinate Geometry disk. When the Coordinate Geometry disk is opened, the icon for the program can be found. Double click the program icon to launch the program.



A Window on Geometry

The Coordinate Geometry Screen is divided into the following sections:

Status	Shows the current activity. In the Macintosh version the status is shown by a check mark to the left of the menu item.
Graphics Window	Used to present the Cartesian Plane and graphic representations of loci.
Options Window	Displays a list of choices.
Text Window	Used to present text information.



Control Keys (Apple //)

Several menus are presented during the use of this program to allow the user to select topics, activities and answers. All menus work the same. The arrow keys are used to move the indicator to a choice and the return key is used to select the indicated choice. The escape key can be used to return to a previous menu.

[Arrows]	**Move indicator to a choice.**
[Return]	**Select the indicated choice.**
[Escape]	**Return to previous menu.**

Control Buttons (Macintosh)

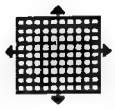
Buttons are used to control activity in the Macintosh version of Coordinate Geometry.

The right arrow button is used to advance to the next screen in the lesson.

The left arrow button is used to move to the previous screen in the lesson.

The up and down directional control buttons are used to increase or decrease the value of the y-coordinate (ordinate).

The right and left directional control buttons are used to increase or decrease the value of the x-coordinate (abscissa).

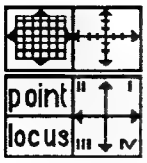


The plot button is used to plot on the Cartesian Plane the point, line or locus of points that have been defined by the user.

When erase button is selected the grid is cleared.

This button is used to increase or decrease the size of the figure.

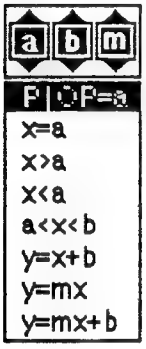
This button is used to increase or decrease the number of the polygon.



This group of five buttons are used to select one of three backgrounds or to define a point or locus.

This button is used to increase or decrease the value of the x-ccordinate.

This button is used to increase or decrease the value of the y-ccordinate.



The three buttons at the top of this menu are used to increase or decrease the value of the a, b or m variable. Pointing to one of the items in the list of loci definitions instructs the computer to plot a graph of the selected locus.

This button is used to set the slope to positive one (+1) or negative one (-1).

This button is used to set the value of the b-term (y-intercept).

Main Menu (Apple //)

One of the seven units, the final test or the screen option can be selected from the Main Menu. To make a selection press the arrow keys to move the

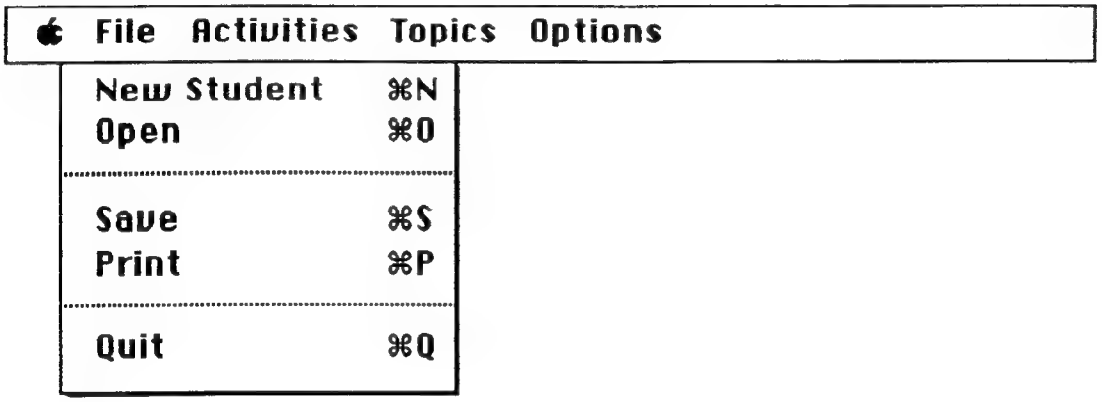
indicator to the desired topic and press the return key. Once a topic has been selected choose one of the activities.

To exit the learning system use the arrow keys to move the indicator to the word Quit and press return.

Menus (Macintosh)

File Menu

The File Menu contains five options:



New Student Selecting new student from the File Menu causes the program to open the New Student window and allow the user to enter his/her name, class period, and date of use. This information can the be stored in a file along with the scores achieved on the quizzes and the final exam. (See Open and Save options.)

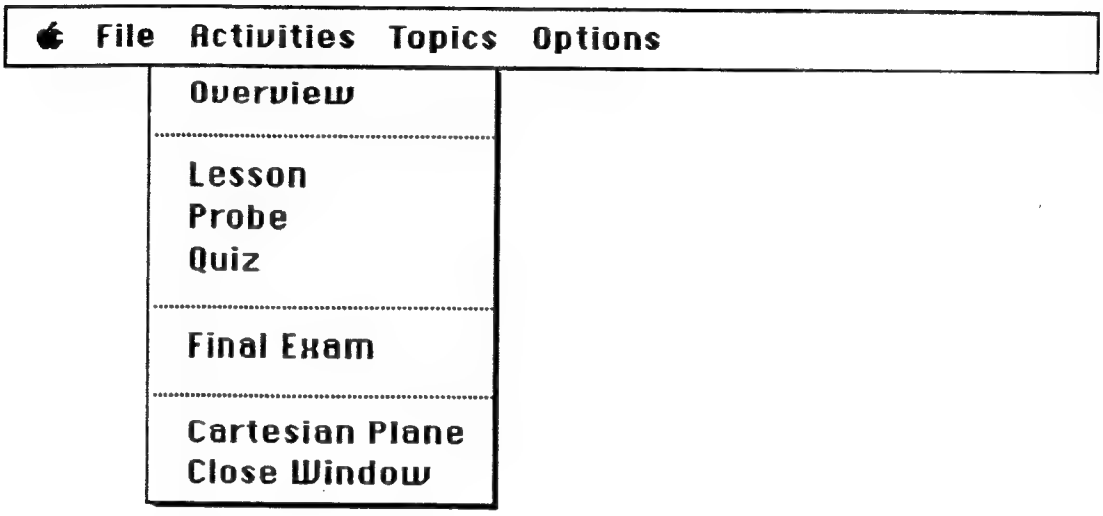
Open After selecting Open from the File Menu a standard file dialog box is displayed. Only files that were stored using the Save option will be shown in the list of files. To Open the file either double-click the file name or select the file and choose the open button.

Save Choosing Save from the File Menu causes a standard file dialog box is displayed with a place for the user to type the name of the file. Type the name of the file (usually the students name) and select the save button. A record of the student's current scores will be recorded in the file.

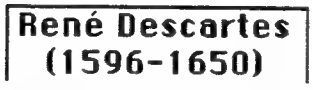
Print When the print option is available it can be used to print the current window.

Quit Quit is used to terminate the program.

Activities Menu The Activity Menu contains seven options:



Overview The Overview activity presents background information on Descartes and Coordinate Geometry. Click the mouse pointer on the box which tells the period when René Descartes lived to read more information.



Click anywhere else in the window to continue. When reading the additional information click on the small arrow in the right corner of screen to continue.

Lesson The Lesson activity presents information about the selected topic. Arrow buttons are used to move forward and backward through the lesson.

Probe Each Probe is different based on the selected topic. Options are present in each Probe to make it possible for the user explore concepts related to currently selected topic.

Quiz The Quiz option initiates a question sequence based on the currently selected topic. Questions are randomly generated based on specific objectives.

Final Exam The Final Exam consists of a set of 35 questions. Choosing this option initiates the final exam. As in the quiz, questions are randomly generated based on specific objectives.

Cartesian Plane Choosing the Cartesian Plane option opens a window where an exploratory environment is created for experimenting with locating points and lines on a grid. Set of points can be defined and store on disk, the recalled.

Close Window The Close Window option closes the current window.

Topics The Topics Menu contains seven options:

(x,y)	Locating points.
Locus	Defining sets of points.
Plane	Defining circles and planes on a grid.
y=x	Defining a 45° line.
y=x+b	Defining a 45° line and a y-intercept.
y=mx	Defining the slope of a line (rise over run).
y=mx+b	The equation of a line.

Options The Options Menu is used to control general features of the program:

Sound Sound is controlled through this option and can be set on or off. When the sound is on this menu item is checked.

Scoreboard The Scoreboard option causes the computer to display the scoreboard window. This window can be printed.

Colors If the program is used on a Macintosh with color capabilities, the color of the points, lines

and planes that are plotted can be set by choosing one of the colors listed.

Editor

When using the Cartesian Plane activity the editor can be switch on or off. When the editor is on, the set of points shown in the scrolling field in the upper right corner can be edited.

Coordinate Geometry

Instructional Objectives

The following objectives are supported by Coordinate Geometry:

The student will...

(x,y)

1. determine which of four points are the furthest from the origin.
2. correctly determine if the abscissa or ordinate for a point in any quadrant is positive or negative.
3. state which axis a point is on if the abscissa or ordinate is zero.
4. determine whether a given point is in the interior region of a rectangle shown on a Cartesian plane.
5. name the correct quadrant for a point when given the coordinates of any point in the quadrant.

Locus

6. define the term locus.
7. select a point from a set of four points which is not included in a graphically represented locus.
8. determine if a point defined by its abscissa and ordinate is included in a given locus.
9. select the correct coordinate pair to define a graphically represented point.
10. recognize that any path which satisfies a condition is a locus.

Plane

11. recognize that a circle can be defined as all points in a plane that are a given distance from a point.
12. select the correct set notation for a graphically represented circle.
13. determine if a graphically represented plane is correctly defined by a set notation given in the form {(x,y) | a<x<b and c<y<d}.
14. select the correct line for a set notation statement given in the form {(x,y) | x=a}.
15. select x-axis, y-axis or origin to satisfy a condition stated in set notation.

y=x

16. select the point in a graphically given set of points which is not on the line determined by y=x.
17. select which point in a set of three points given as coordinate pairs is on the line y=x.

18. select the correct set notation for a graphically represented line with either a positive or negative slope.
19. determine if two graphically given points are on the line given by the equation y=x.
20. state the number of degrees in the angle created by the line y=x.

y=x+b

21. recognize that the y-intercept is the point at which a line crosses the y-axis.
22. state the y-intercept for a line given in the form y=x+b.
23. determine if a set of three points lies on a straight line.
24. select the correct equation for a graphically represented line.
25. determine the correct equation for a line parallel to y=x and passing through a given point.

y=mx

26. match the term slope to its definition.
27. determine if the slope of a given line is positive or negative.
28. select the correct slope for a graphically represented line.
29. determine the slope of a line passing through a given point and the origin.
30. recognize that any line with an equation in the form y=mx passes through the origin.

y=mx+b

31. recognize that in the equation of a line the slope is the coefficient of the x-term.
32. recognize that when a constant is added to the x-term the line does not pass through the origin.
33. determine if a given equation is correct for a graphically represented line.
34. select the correct ratio for a graphically represented line.
35. determine which is the correct equation for a line that is parallel to a given line and passes through a given point.

Activity Menu

The main activities for the student using Coordinate Geometry are Lessons, Probes, Quizzes and the Final Exam. The choice made from the Topic menu determines which activity is presented.

(x,y) Lesson

The (x,y) unit introduces the basic concepts in coordinate geometry. The Cartesian Plane is introduced and an explanation is given as to how the

plane is constructed. The x-axis and y-axis are shown and the meaning of the term origin is discussed. The labels for the four quadrants are presented. The use of coordinate pairs to define a point on the plane is explained and the terms abscissa and ordinate are introduced.

The term set is explained as any clearly defined group of items. Elements are items or members of a set. Set notation is used to define a collection of points shown on the grid. The null set is explained as a set with no members and an intersection is explained as a condition where two sets have common elements.

To use the lesson, select 'lesson' from the Activity Menu by moving the indicator to the word 'lesson' and pressing return. To proceed through the lesson Apple // users can press any key when the word 'Page' appears in the options window. Macintosh users can select the right or left arrow buttons to move through the lesson.

(x,y) Probe

The probe activity for the (x,y) unit allows the user to define a point on the Cartesian Plane by entering the abscissa and the ordinate. The program automatically labels the point and displays its position on the grid. The computer will also tell the student in which quadrant the point lies.

To exit the probe and return to the Unit Menu either press escape or press return instead of making an entry for the abscissa.

(x,y) Quiz

This quiz measures mastery of objectives 1 through 5.

Locus Lesson

The lesson titled Locus introduces the student to the concept that a locus is a set of points which satisfy a condition. Examples of loci are presented in the lesson and the examples include circles, lines and planes.

Locus Probe

The probe for this unit is a creative experience in making designs with the computer. The process begins by first selecting either a shape or circle. The design created will be based on this first choice.

If the Shapes option is selected for the type of design a menu is presented where the user can set the number of sides for a regular polygon and the size of the polygon (distance from the center of the figure to one of the vertices). The size, number of sides, and color of the design can be

controlled by the user and the current setup is displayed in the Text Window. When satisfied with the current setup Apple users select OK and Macintosh users select the plot button. The computer will automatically process the design. For Apple // users, Clear erases the Graphics Window and Reset is used to return to the first menu. Macintosh users clear the design by click on the eraser.

When the Circle option is selected as the type of design, the user can set the size and aspect ratio of a circle. The aspect option is used to set the ratio of the horizontal axis to the vertical axis and can be used to 'scrunch' the design. The user can define the two circles used to create the design. The options R1, R2 and Step refer to the size of the first circle, size of the second circle and step factor, respectively. After setting up the two circles, Apple // users press the escape key to return to the circle design menu. From this menu the user can select Ok to plot the design. The color option is used to set the color of the design. Clear erases the graphics window and Reset returns the user to the first menu. Macintosh users can plot the design by choosing the plot button. The eraser button erases the design. Color is set from the options menu.

The design drawn from the Shape option is created by plotting lines to connect the vertices of polygons. The design created from the Circle option is generated from a mathematical simulation of two points on different circles orbiting at different speeds (step factor).

Locus Quiz

This quiz measures mastery of objectives 6 through 10.

Plane Lesson

This lesson introduces the concept that a circle can be defined as a locus of all points in a plane that are a given distance from a certain point. This idea is graphically represented on the Cartesian Plane and the set notation for a circle, {P | OP=5} is also introduced. The definition of a line parallel to the y-axis is presented and this type of locus is described using the set notation {(x,y) | x=4}.

A plane is a locus of points. The set notation for a plane M is given in this lesson. The notation used in the example is {(x,y) | x>0}. A second set notation for a plane is given as {(x,y) | -4<x<-1} and the meaning of this notation is explained.

An example of compound loci is given as a line which intersects a plane. The definition of a compound locus is given and the symbol for intersection is presented. The origin is described as a compound locus where {(x,y) | x=0} and {(x,y) | y=0}.

Plane Probe

The probe in this unit is used to explore the concepts introduced in the lesson and also to experiment with ideas presented in other lesson.

The user can select the type Cartesian Plane that is displayed in the graphics window. Grid lines, tick marks and quadrant labels can optionally be displayed or not displayed.

The choices for type of plotting are Point or Locus. If Point is selected a statement appears in the Text Window and defines the point that the computer is set to plot. The value of the x-coordinate can be altered by choosing x in the menu. The y-coordinate can also be selected.

The Locus option leads to eight options given in set notation. The first option, P | OP = a allows the user to enter a radius and plot a circle. Figures can be overlaid on the same grid.

The second option, x=a, allows the user to enter a value for the x-coordinate. This value can be positive, negative or zero. The third and fourth options (x>a and x<a) are used to define planes where the x-coordinate is either greater than or less than a selected value.

The fifth option defines a plane where two conditions are specified for the x-coordinate (a<x<b). The sixth option, y=x+b, allows the user to explore this equation. The y-intercept can be selected and each line plotted will have a slope of 1. The seventh option, y=mx, allows the user to enter a slope. All lines drawn will intersect at the origin. The eighth option, y=mx+b, allows the user to define a slope and an intercept.

Plane Quiz

This quiz measures mastery of objectives 11 through 15.

y=x Lesson

This lesson introduces the concept that the line y=x is derived from the set of all points where the x and y coordinates are equal. First this is shown using a square. In the second example points with coordinates that are equal are shown.

The lesson explains that points which lie above the line y=x have a y-coordinate which is greater than the x-coordinate and points which lie below the line have a y-coordinate which is less than the x-coordinate.

The concept of a negative slope where the x and y coordinates have an inverse relationship is also presented.

y=x Probe

The probe from the y=x unit is used to explore and discover. The program allows the user to define either the x-coordinate or the y-coordinate for a point. When an x-coordinate is defined the same value for the y-coordinate is automatically assigned. If a y-coordinate is entered the same value for the x-coordinate is assigned.

The computer automatically shows the location of each point on the grid. The user will discover that all points lie along the same line. Each point is automatically assigned the next letter of the alphabet.

y=x Quiz

After selecting Quiz from the y=x Unit Menu, select the option Begin to start the quiz. This quiz measures progress on objectives 16 through 20.

y=x + b Lesson

The y=x+b Lesson begins by reviewing the y=x equation for a line. Three points on the y=x line are presented. The program then demonstrates what will happen if a constant is added to the y-coordinate of each point in the set. The resulting line is parallel to the first line but crosses the y-axis above the y=x line.

The y-intercept is the point where a line intersects the y-axis. The value of the y-intercept can be positive or negative.

y=x + b Probe

The y=x+b probe can be used to enter a positive or negative sign for the coefficient of x and to enter the y-intercept. Use this probe to explore the equations of lines that have a slope of positive or negative 1 and intercept the y-axis either above or below the origin.

y=x +b Quiz

After selecting Quiz from the y=x+b Unit Menu, select the option Begin to start the quiz. This quiz measures progress on objectives 21 through 25.

y=mx Lesson

Coordinate Geometry

The unit on y=mx begins by showing three points on the line y= $^1/_2$x. This line passes through the origin. Other examples of lines that fit the equation y=mx are shown and a pair of points on one of the lines is examined. The ratio of ordinate to the abscissa for all the points on this line is the same. The ratio, or slope, is sometimes described as the rise over the run.

Lines with positive and negative slopes are presented and the fact that the coefficient of the x-term is the slope is reviewed. The convention of using 'm' to designate the slope is explained.

y=mx Probe

The probe for this unit allows the user to define a slope for a line in the form y=mx. The ratio of the ordinate to the abscissa is entered by first selecting mx and then selecting to define the rise or the run. A color can be selected for the line. When the desired line is defined, select OK to plot the line.

y=mx Quiz

After selecting Quiz from the y=mx Unit Menu, select the option Begin to start the quiz. This quiz measures progress on objectives 26 through 30.

y=mx+b Lesson

The standard equation for a line is introduced in the seventh unit. This lesson begins by reviewing the y=x equation and the fact that the abscissa and ordinate for any point on this line is equal. Next the y=x+b equation and concept of the y-intercept is reviewed. The difference between a positive and a negative slope is also reviewed before introducing the y=mx+b equation of a line.

The term slope is used to describe the coefficient of the x-term. The y-intercept is described as any constant added to the x-term. An example of a line in the form y=mx+b is given.

y=mx+b Probe

The probe for the y=mx+b unit allows the user to enter two lines in the form y=mx+b and to find the point of intersection for the two lines. To begin, choose to define the First or Second line. At the onset the program is set to plot the same line, y=x. Use the menu to change the slope and y-intercept for the two lines.

If the lines selected have the same slope the word 'parallel' will be shown below the grid. If the lines are not parallel the computer will display the point at which the lines intersect. Select OK when ready to plot.

y=mx +b Quiz

After selecting Quiz from the y=mx+b Unit Menu, select the option Begin to start the quiz. This quiz measures progress on objectives 31 through 35.

Test

To measure overall achievement on the objectives of this program, select Test from the Main Menu. The Test option causes the computer to execute each of the seven quizzes in order. Thirty-five questions are presented in all. At the end of the test a percentage score is given. Since most of the questions presented use values randomly selected by the computer it is appropriate for an individual to use the test more than once.

Screen (Apple //)

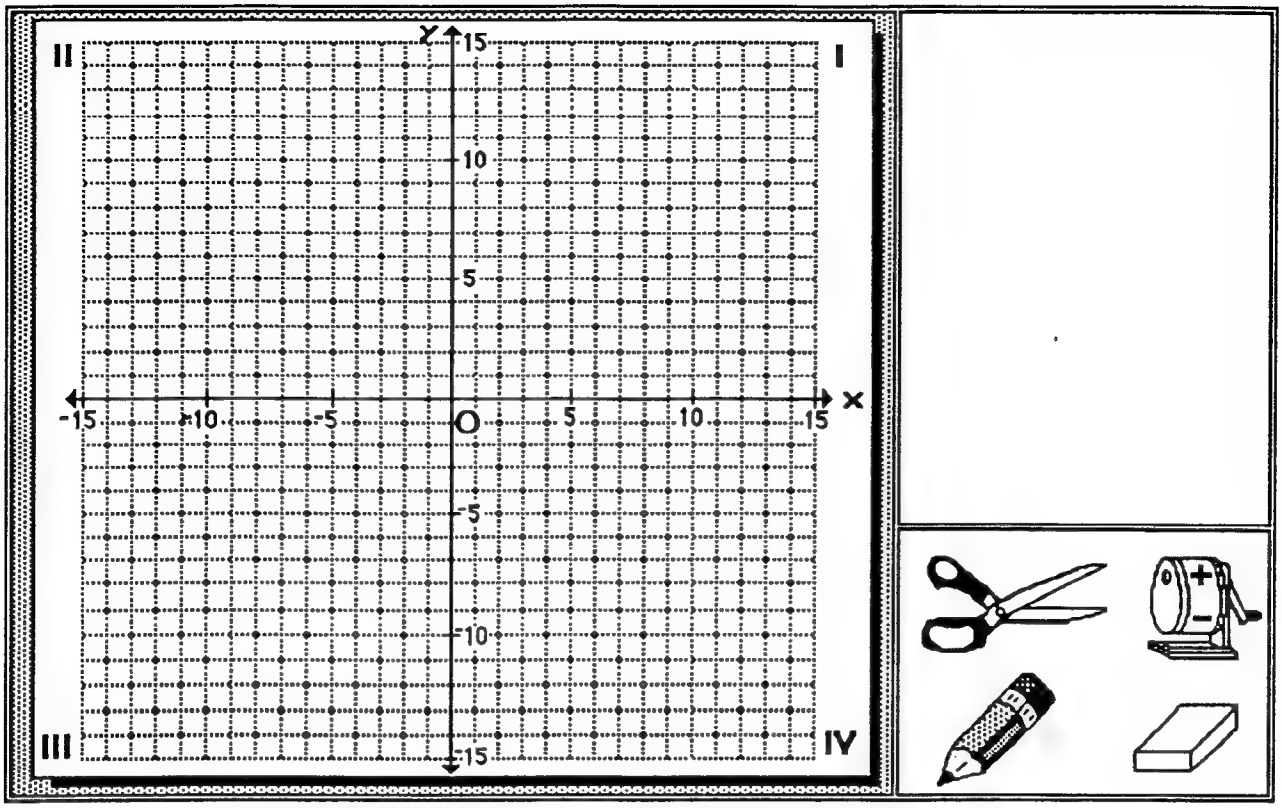
Using the probes students can plot points, lines, circles and other types of loci. After plotting points using any of the probes, the student may return to the Main Menu and from there select the Screen option. The Screen option gives the student the options: Title, Lines, Save, Load, and Menu. (A DOS 3.3 initialized disk is required for storage.) The Title option permits the user to enter a two line title at the top of the screen. (The first line of the title will become the name of the file when the picture is transferred to the storage disk. The extension, .PIC, is added to the name of the file.) The Lines option allows the student to write two lines of descriptive text that will be shown at the bottom of the screen.

The Save option transfers a copy of the image on the screen to the disk. Select Drive 1 or Drive 2 for output. The Load option recalls an image from either Drive 1 or Drive 2. If a graphics printer is available the image can be printed using screen dump utility software.

Cartesian Plane (Macintosh)

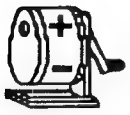
The Cartesian Plane Activity allows the student to draw lines on a grid by connecting points in sequence.

Coordinate Geometry



Four buttons are available in this activity:

The scissors button is used to cut a point from the sequence.



The pencil sharpener has two functions. Click on the plus sign to increase the size of the line. Click on the minus sign to decrease the size of the line.

The pencil button is used to lift the pencil and start drawing from a new point.

Clicking the eraser button clears the grid.

If the editor is selected (checked in the Option Menu) the coordinates of points are recorded and shown as the drawing is created. A list of the coordinates is displayed in a scrolling text field. This list can be saved by selecting Save from the File Menu.

If the editor is not selected (unchecked in the Option Menu) the coordinates of points are not recorded nor shown as the drawing is created. The drawing can be saved, but the coordinates are not retained.

The grid can be printed by selecting Print from the File Menu

Supplementary Materials

Reproducible black-line masters are provided for classroom use. Each worksheet is designed to be used with the probe option available in each unit. The worksheets are self-explanatory and can be used to guide the student's exploration of coordinate geometry which is made possible with each of the probes.

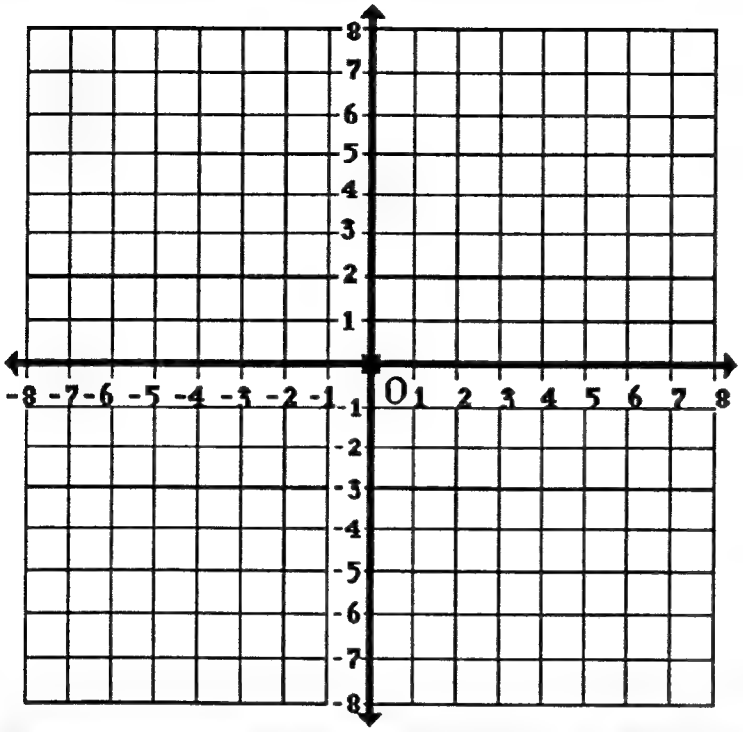
Student Record Sheet

The page may be reproduced and used by the student to document the progress made in using the Coordinate Geometry learning system. Use the form to check off the lessons and probes as they are completed and to record the scores achieved on each of the quizzes and for the test.

Name_____ Date_____

(x,y) Coordinate Pairs

Use the Probe to enter an abscissa and an ordinate for points on the Cartesian Plane. Complete these activities.



Record the location of each point on the grid.

Abscissa
x-axis

Ordinate
y-axis

Complete the table shown below. Define the set of points (A-J).

Point	X	Y	Quadrant	Point	X	Y	Quadrant
A				F			
B				G			
C				H			
D				I			
E				J			

If a point has these signs, in which quadrant is it located?

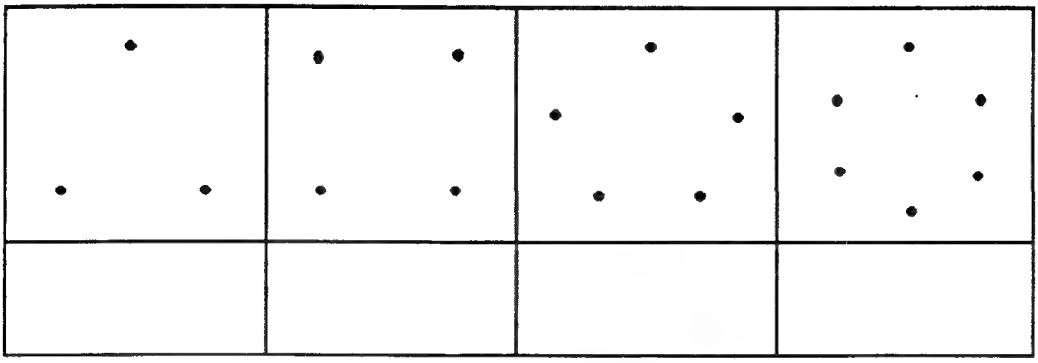
X	Y	Quadrant	X	Y	Quadrant
+	+		−	+	
+	−		−	−	

Name_____ Date_____

Locus of Points in a Plane

Select Locus from the Topic Menu. Use the Probe to create designs. Complete these experiments. Find the rule that explains your findings.

Connect each point to every other point in these shapes:



Number of Sides	Number of Lines	Name of Shape
3		
4		
5		
6		
7		
8		

Can You Find the Rule?

Study the table and the pattern produced by the numbers in the second column of the table. State a rule that can be used to predict the number of lines needed to connect any number of vertices.

_____

_____

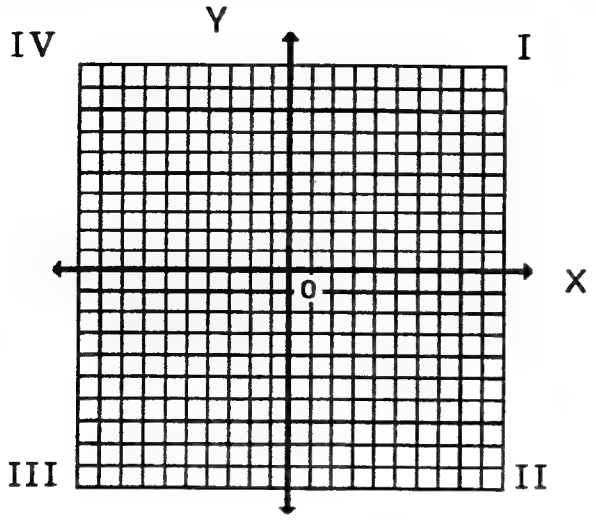
_____

_____

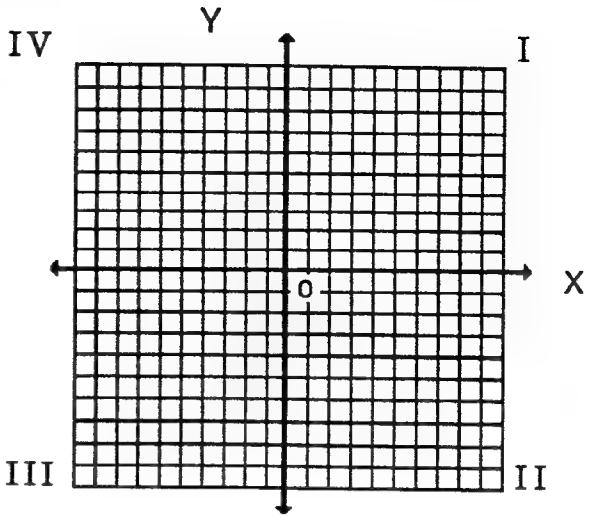
Name_____ Date_____

Plane

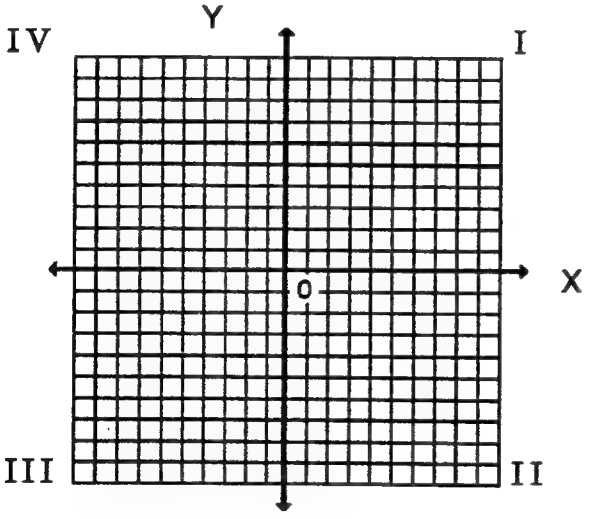
Select Plane from the Topic Menu. Plot each locus given below using the Probe. Draw each locus on the grids provided.



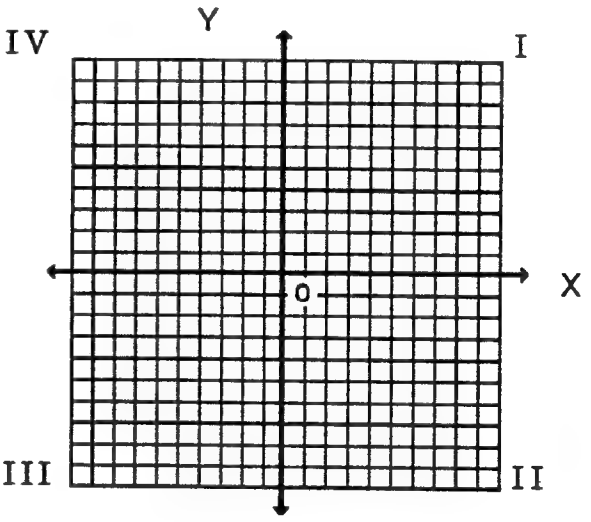
S={A(-3,4),B(-5,2),C(6,5),D(-3,-2)}



C={P | OP=4}



L={(x,y) | x=5} and M={(x,y) | x>8)



N={(x,y) |3<x<5} and W={(x,y) | y=x}

S={A(-3,5),B(3,5),C(-3-5),D(3,-5)} T={(x,y) | x>2}

How many points are in both sets S and T? _____

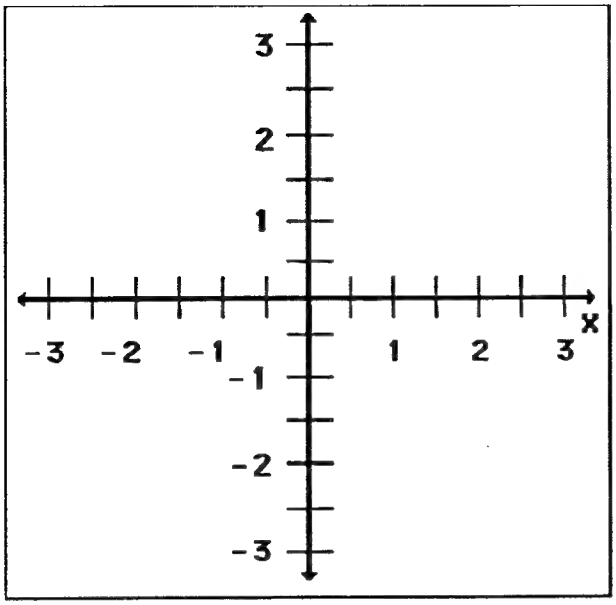
U={A(-3,5),B(-2,6),C(-4,-5),D(3,-3),D(3,2),E(-3,8)}

How many points are in set U are in quadrant II? _____

Name_____ Date_____

y=x Equation of a Line

Select y=x from the Topic Menu and then Probe from the Activity Menu. Plot the points given in the table below. Draw a line to connect the points.



	X	Y
A	-3	-3
B	2	2
C	1	1
D	1.5	-1.5
E	2.5	2.5

Question!
Is each point the same distance from the x-axis as it is from the y-axis?

☐ *Yes* ☐ *No*

Explore!
Each of these points lie on the line y=x. Supply the missing values for each coordinate pair.

(100, _____) (-13,_____) (_____, -15)

(-8,_____) (9,_____) (64, _____)

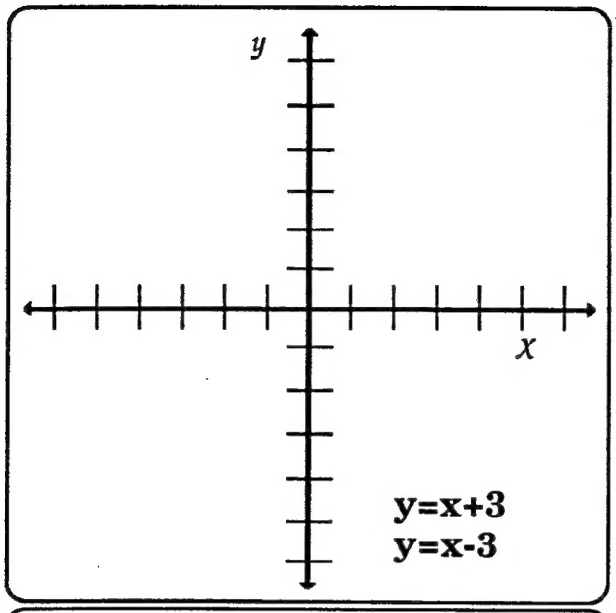
Do You Know?
All of the points on this page are on a line that passes through the point (0,0). What is the special name for the point?

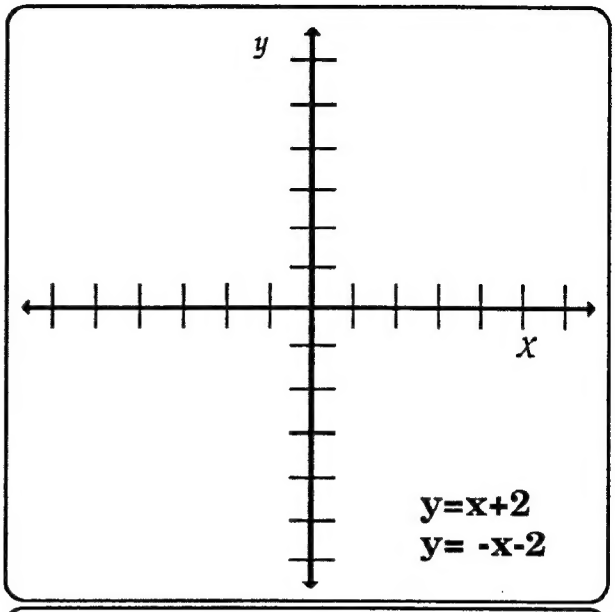
_____

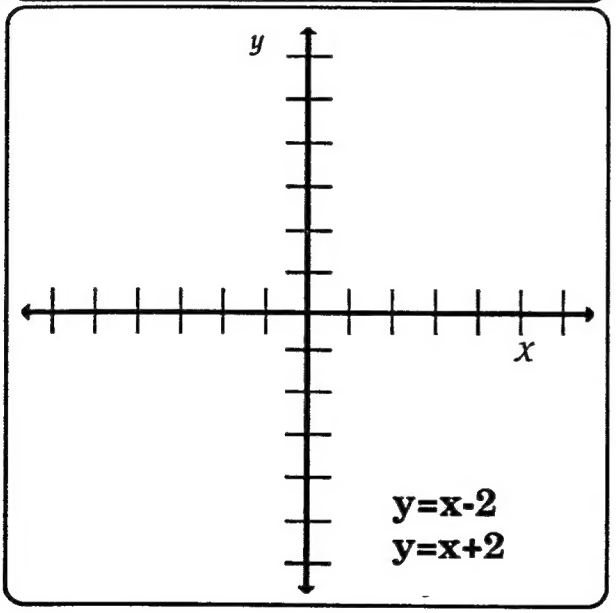
Name_____ Date_____

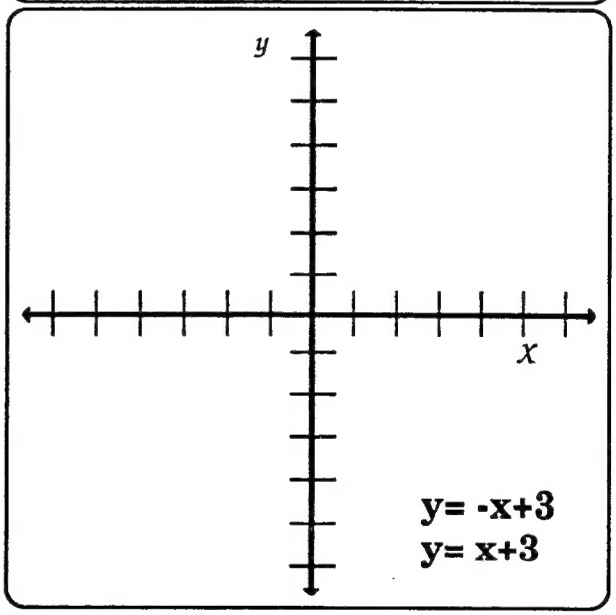
y=x+b Equation of a Line

Select Plane from the Topic Menu. Plot the lines given for each grid using the Probe Activity. Record your activity by drawing lines on these grids.









Think About This!

What effect does the value of the b-term have on the position of the line?

_____

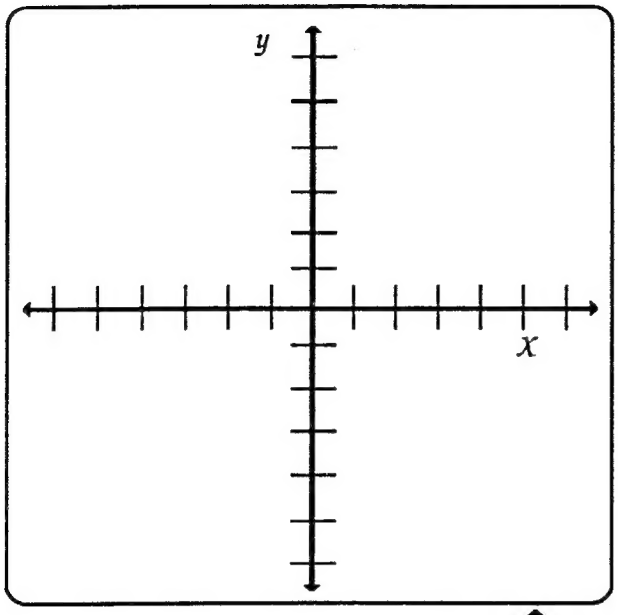
_____

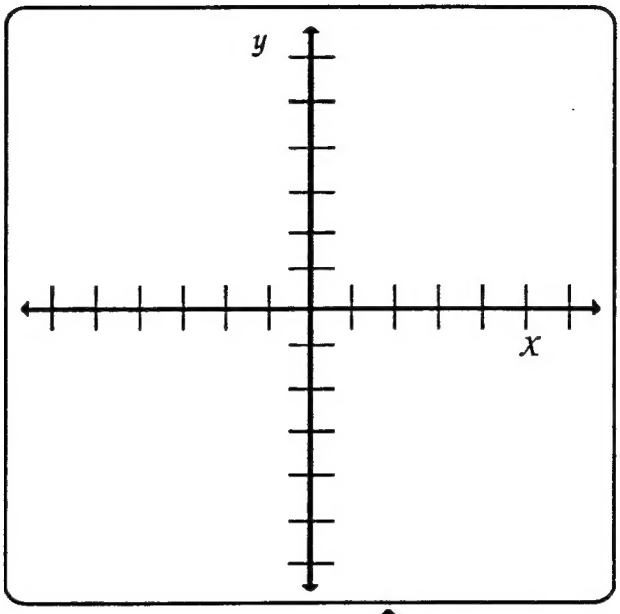
_____

Name_____ Date_____

y=mx Equation of a Line

Use the Probe with the Topic Menu set on y=mx to plot the lines given at the top of each table. Complete the table by filling in the blanks. Record your activity on these grids.





	y=3x	y=-x	$y=\frac{1}{2}x$
Coordinates of any point.			
Coefficient of x.			
Ratio of the ordinate to abscissa			

y=3x	y=-x	$y=\frac{1}{2}x$

Write About It!

Explain in your own words the relationship between the coefficient of x and the ratio of the ordinate to the abscissa.

_____

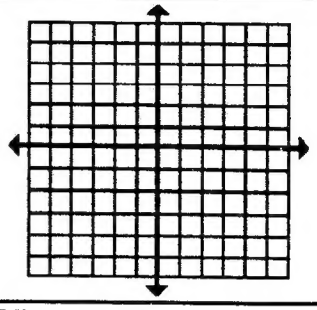
_____

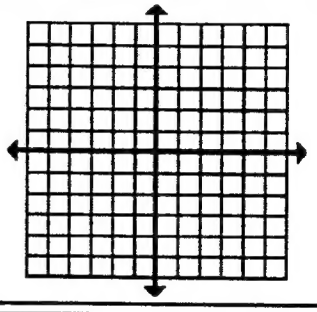
_____

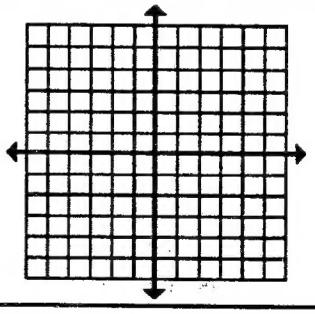
Name_____ Date_____

y=mx+b Equation of a Line

Use the Probe with the Topic set on the y=mx+b to plot the pairs lines given below. Draw the lines on the grids and complete each table. Write "parallel" if the two lines are parallel.

Equation	slope	y-intercept	Intersection	Graph
y=2x+3				
y=-x-2				
$y=\frac{1}{2}x$				
$y=\frac{2}{3}x-1$				

Equation	slope	y-intercept	Intersection	Graph
y=3x+1				
y=-x-2				
$y=\frac{-1}{2}x$				
$y=\frac{2}{3}x-1$				

Equation	slope	y-intercept	Intersection	Graph
y=x+4				
y=-x-2				
$y=\frac{2}{3}x$				
$y=\frac{2}{3}x-1$				

Super Challenge!

Write the equations for two lines that intersect.

Name_____ Date_____

Record Sheet

Use this record sheet to record your progress. Record the date. Mark each lesson and probe with a check when complete. Write the score achieved on each quiz and on the test. Analyze your performance

Unit	Date	Lesson	Probe	Score
(x,y)				
Locus				
Plane				
y=x				
y=x+b				
y=mx				
y=mx+b				
Test				

Analyze Your Performance!

What is the highest score you attained? _____

What is your lowest score? _____

What is your average score? _____